"EFFECTIVENESS OF FORWARD VERSUS BACKWARD STEPPING STRATEGY IN BODY WEIGHT SUPPORT TREADMILL TRAINING ON FUNCTIONAL MOBILITY AND BALANCE AMONG SPASTIC DIPLEGIC CEREBRAL PALSY"

- A SIMPLE RANDOMIZED EXPERIMENTAL STUDY

A project submitted in partial fulfillment

of the requirement for the degree of

MASTER OF PHYSIOTHERAPY

Submitted by

Reg.No:271720206

Under the guidance of

Prof. Dr.M.PRADEEPA, MPT (Neurology), MIAP

Submitted to

THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY

CHENNAI -32

PPG COLLEGE OF PHYSIOTHERAPY

COIMBATORE- 35.

MAY 2019

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Dissertation Evaluated on ……

INTERNAL EXAMINER **EXTERNAL EXAMINER**

CERTIFICATE – I

This is to certify that the dissertation work entitled **"EFFECTIVENESS OF FORWARD VERSUS BACKWARD STEPPING STRATEGY IN BODY WEIGHT SUPPORT TREADMILL TRAINING ON FUNCTIONAL MOBILITY AND BALANCE AMONG SPASTIC DIPLEGIC CEREBRAL PALSY -A SIMPLE RANDOMIZED EXPERIMENTAL STUDY** was carried out by **Register number:271720206**, PPG College of Physiotherapy,Coimbatore-35, affiliated to The Tamil Nadu Dr. M.G.R. Medical University, Chennai-32, under the guidance of **Prof.Dr.M.PRADEEPA,MPT(Neurology), MIAP**

PRINCIPAL

Prof. Dr. C. SIVAKUMAR,MPT (Orthopedics).,Ph.D.,MIAP

CERTIFICATE – II

This is to certify that the dissertation work entitled **"EFFECTIVENESS OF FORWARD VERSUS BACKWARD STEPPING STRATEGY IN BODY WEIGHT SUPPORT TREADMILL TRAINING ON FUNCTIONAL MOBILITY AND BALANCE AMONG SPASTIC DIPLEGIC CEREBRAL PALSY – A SIMPLE RANDOMIZED EXPERIMENTAL STUDY" w**as carried out by **Register number: 271720206**, P.P.G College of Physiotherapy,Coimbatore-35, affiliated to The Tamil NaduDr.M.G.R. Medical University, Chennai-32, under my guidance and supervision,

GUIDE

Prof.Dr.M.PRADEEPA, MPT (Neurology), MIAP

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"EFFECTIVENESS OF FORWARD VERSUS BACKWARD STEPPING STRATEGY WITH BODY WEIGHT SUPPORT TREADMILL TRAINING ON FUNCTIONAL MOBILITY AND BALANCE AMONG SPASTIC DIPLEGIC CEREBRAL PALSY"

- A SIMPLE RANDOMIZED EXPERIMENTAL STUDY-

ABSTRACT

BACKGROUND OF THE STUDY:

The term cerebral palsy describes a group of disorders attributed to non-progressive disturbances that occur in the developing fetal or infant brain and result in a cluster of disorders that impact development of movement and posture, causing activity limitation.

OBJECTIVE:

The aim of the study is to find out the effectiveness of forward stepping vs backward stepping strategy with body weight–supported treadmill training on functional mobility and balance among spastic diplegic cerebral palsy.

METHODOLOGY:

28 children with spastic diplegic cerebral palsy were screened for the study on that 24 subjects who come under selection criteria were selected for this study were selected for this study based on the selection criteria and they were randomly allocated in to two groups by using tossing method. Subjects in group A were treated with forward stepping in BWSTT and subjects in group B were treated with backward stepping in BWS TT. Both the group received intervention for 6 weeks. The baseline and post test score were measured by using Gross Motor Function Measure – Walking dimension, Paediatric Berg Balance Scale and TUG test.The results suggest that the effects of forward stepping versus backward stepping strategy with body weight–supported treadmill training improving functional mobility and balance among spastic diplegic cerebral palsy. In GMFM,the t value obtained for Group A -6.20106 and Group B -10.68867. In MTUGT, the t value obtained for Group A 4.50641 and Group B 12.364. In

Pediatrics balance scale the t value obtained for Group A -13.868 and Group B -7.50341. The obtained t value is greater than the table value at the significant level of 0.05.Hence the statistical report states that there were statistically significant differences in posttest comparison

The post score values of the Gross Motor Function Meaure-88, Paediatric Berg Balance Scale and TUG test score in all the variables showed significant difference.

CONCLUSION:

Finally, the study concluded that the 6 weeks of backward stepping body weight support treadmill training program along with regular physiotherapy treatment showed statistically significant improvement in balance and functional mobility among spastic diplegic children when compared to forward stepping body weight support treadmill training program.

KEYWORDS:

Spastic cerebral palsy, Body Weight Support Treadmill Training (BWSTT), Balance, Functional Mobility, Paediatric balance scale.

CHAPTER – I

1.1 BACK GROUND OF THE STUDY:

Cerebral palsy is a common neuro developmental condition encountered by pediatricians. The condition may present itself in many different clinical spectra. In many cases, the cause of Cerebral palsy may not be apparent. Cerebral palsy is invariably associated with many deficits such as mental retardation, speech and language and oromotorproblems.[1]

The traditional definition of CP is a non-progressive impairment in movement or posture caused by injury or anomaly of the developing brain.[2]

Cerebral palsy (CP) describes a group of disorders in movement and posture that limits activity and is attributed to disturbances in the developing fetal or infant brain.[3]Spastic diplegia is one of the most common types of CP in which lower limbs are affected more than upper limbs. Children with diplegic CP encounter difficulties in sensory processing and integration which influence the achievement of mature postural control.[4]Consanguinity, birth asphyxia, neonatal jaundice are found to be the important risk factors for CP in our study which can be avoided by improving maternal and paediatric health services.[5]

CLASSIFICATION:

The topographical classification of CP is monoplegia, hemiplegia, diplegia and quadriplegia: monoplegia and triplegia are relatively uncommon.

Early signs of cerebral palsy include cerebral palsy is a clinical diagnosis made by an awareness of risk factors, regular development screening of all high risk babies and neurological examination. As in all medical conditions, a systematic approach focusing on maternal, obestrics and perinatal histories, review of developmental milestones and a through neurological examination and observation of the child in various positions such as supine, prone, standing, walking and running is mandatory. It is not possible to diagnose CP in infants less than 6 months except in very severe cases. Another early feature is persistence of prominent feature, abnormalities of tone-either spasticity or hypotonia of various distribution, persistence of abnormal neonatal reflexes, delay in the emergence of protective and postural reflexes, asymmetrical movements like asymmetrical crawl and hyperreflexia.[6]

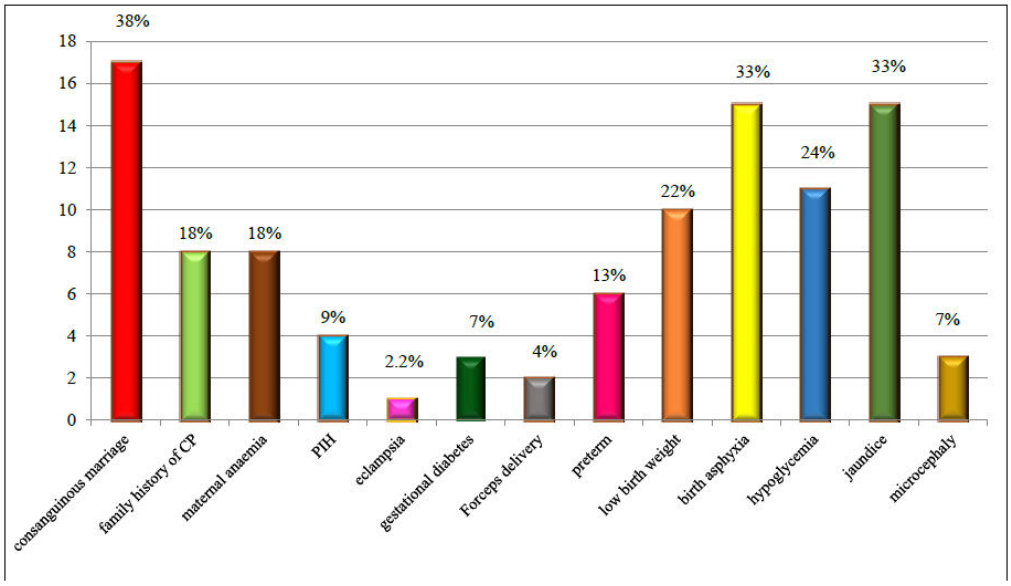
The CP children have gait pathologies and tend to lose independent walking at later stages of life because of knee problems, increased spasticity, balance problems, and lack of physical training.[7]

Poor balance control is one of the most contributing factors for poor gait and reaching movement because the maintenance of stability is critical to all movement.[8]

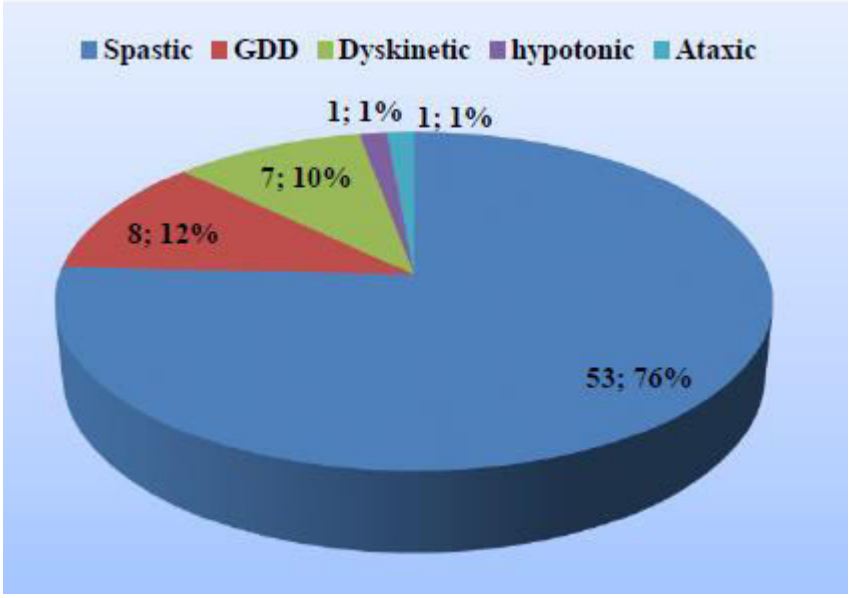
There are increasing evidences suggesting rise in prevalence of CP. Profile of CP in developing country is also different from developed countries.[4]

Modern improved obstetric and advanced prenatal care had resulted in increased survival of low birth weight babies and is associated with an increased proportion of cerebral palsy in these babies.[9]

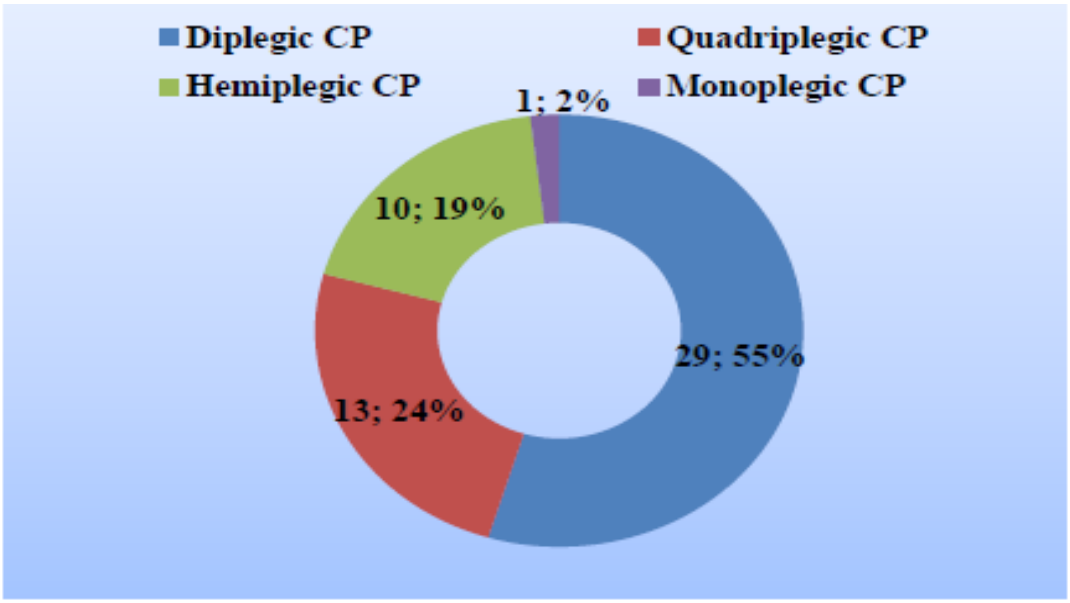
Risk factors include preterm birth, being a twin, certain infections during pregnancy such as toxoplasmosis or rubella, exposure to methylmercury during pregnancy, a difficulty delivery and head trauma during the first few years of life among others. About 2% of cases are believed to be an inherited genetics cause.[5,6]



Spastic CP was the most common type (76%) followed by Dyskinetic 10%, 1% each in hypotonic and Ataxic CP. 12% cases were of evolving CP infants with Global developmental delay (GDD).[10]



Amongst the Spastic CP, Diplegia was present in maximum cases (55%) followed by Quadriplegia 24%, Hemilplegia 19% and Monoplegia 2%.[10]



EPIDEMIOLOGY OF CEREBRAL PALSY:

Population-based studies from around the world report that the prevalence estimates of CP range from 1.5 to more than 4 per 1,000 live births or children of a defined age range. The overall birth prevalence of CP is approximately 2 per 1,000 live births.[11]

Its incidence in India around 3 cases per 1000 live births; however, being a developing country, the actual figure may be much higher. There are increasing evidences suggesting rise in prevalence of CP. [12]

The development of independent walking and efficient gait is often a primary focus of physiotherapy interventions for children with CP. Decreased locomotor function is predictive of reduced capacity for activity, participation, and social interaction for children with CP Population-based studies from around the world report that the prevalence estimates of CP range from 1.5 to more than 4 per 1,000 live births or children of a defined age range. The overall birth prevalence of CP is approximately 2 per 1,000 live births. Its incidence in India around 3 cases per 1000 live births; however, being a developing country, the actual figure may be much higher. There are increasing evidences suggesting rise in prevalence of CP.[13]

Physical or mental disability was observed in 1.6% of the population of Tamil Nadu. We observed that about 1 in every 100 person in Tamil Nadu (1635 per 100 000 persons) is either physically or mentally Disabled.[14]

Moreover, these children demonstrate deficiency in anticipatory postural adjustments while standing and walking. clinicians and researchers in the field of pediatric CP have begun to turn their attention to the potential benefits of treadmill training for improving walking in children with CP. It is suggested that treadmill training activates neural circuits that mediate central pattern generators to activate limb muscles repetitively and produced rhythmic movements. [15]

Treadmill training is assumed to modify postural control in children with CP, by permitting multiple repetitions of steps in rhythmic pattern during the gait cycle. Additionally, it adjusts control between agonist and antagonist muscles, leading to enhanced walking speed, and static and functional balance.[16]

1.2 NEED OF THE STUDY:

Spastic diplegia implies that the lower extremities are more involved than the upper extremities where scissoring gait and low grade balance are common. In general physiotherapy techniques such as PNF, Motor Relearning technique, Rood's Approach were effective for CP patients

With a growing body of research evaluating the efficacy of treadmill training for adults with neurologic disorders, most notably after spinal cord injury, clinicians and researchers in the field of pediatric CP have begun to turn their attention to the potential benefits of treadmill training for improving walking in children with CP. This interest is based on the principle that task-specific and repetitive practice is required to develop and improve a motor skill such as walking.

So the need of the study is to find out the effectiveness of forward versus backward stepping strategy in body weight support treadmill on functional mobility and balance among spastic diplegic cerebral palsy are significant in the field of cerebral palsy rehabilitation.

1.3 AIM OF THE STUDY:

The aim of the study is to find out the effectiveness of forward versus backward stepping strategy in body weight support treadmill on functional mobility and balance among spastic diplegic cerebral palsy.

1.4 OBJECTIVES OF THE STUDY:

- To evaluate the effectiveness of forward stepping strategy in body weight support treadmill on functional mobility among children with spastic diplegic cerebral palsy.
- To evaluate the effectiveness of forward stepping strategy in body weight support treadmill on balance among children with spastic diplegic cerebral palsy
- To evaluate the effectiveness of backward stepping strategy in body weight support treadmill on functional mobility among children with spastic diplegic cerebral palsy.
- To evaluate the effectiveness of backward stepping strategy in body weight support treadmill on balance among children with spastic diplegic cerebral palsy.
- To compare the effectiveness of forward versus backward stepping strategy in body weight support treadmill on functional mobility among children with spastic diplegic cerebral palsy.
- To compare the effectiveness of forward versus backward stepping strategy in body weight support treadmill on functional mobility among children with spastic diplegic cerebral palsy.

1.5 HYPOTHESIS:

Null Hypothesis

There would not have been any statistically significant improvement in forward versus backward stepping strategy in body weight support treadmill on functional mobility and balance among spastic diplegic cerebral palsy.

Alternative Hypothesis

There would have been a statistically significant improvement in forward versus backward stepping strategy in body weight support treadmill on functional mobility and balance among spastic diplegic cerebral palsy.

1.6 OPERATIONAL DEFINITIONS:

CEREBRAL PALSY:

Cerebral palsy is an umbrella term covering a group of non-progressive, but often changing motor impairment syndromes which may or may not involve sensory deficits that are caused by a defect, lesion or anomaly of the developing brain.

- **WILLIAMS AND WILKINS**

Cerebral palsy is the commonly used name for a group of conditions characterized by motor dysfunction due to non-progressive brain damage early in life. There are usually associated disabilities as well as emotional, social and family difficulties.

- **SOPHIE LEVITT**

MODIFIED TUG TEST:

Modified TUG is version of TUG test, The TUG test measure is the time taken, in seconds, by an individual to stand up from a standard arm chair, walk a distance of 3meter, turn, walk back to chair, and sit down again.

- **SANJIVANI N.DHOTE**

PAEDIATRIC BALANCE SCALE:

The Paediatric balance scale (PBS), is a modified version of the Berg Balance Scale that is used to assess functional balance skills in school aged children.

- **FRANJOINE MR**

GROSS MOTOR FUNCTION MEASURE (GMFM):

The Gross Motor Function Measure (GMFM) is an observational clinical tool designed to evaluate change in gross motor function in children with cerebral palsy. There are two versions of the GMFM-the original 88-item measure (GMFM-88) and the more recent 66-item GMFM(GMFM-66)

- **SUSAN B O'SULLIVAN**

BODY WEIGHT SUPPORTED TREADMILL TRAINING:

"It consist of suspension system to which a subject is connected so that the weight shifting, balance and stepping can be controlled. The walking is facilitated by treadmill."

-SUSAN B O'SULLIVAN

CHAPTER II

REVIEW OF LITERATURE

2.1 REVIEWS RELATED TO INCIDENCE AND PREVALENCE OF CEREBRAL PALSY:

❖ **EDWIN DIAS, et al., (2017):**

Done a systemic review on cerebral palsy in India. It is found that 10% of the global population has some form of disability from different causes; in India, it is 3.8% of the population. Nearly 15-20% of physically disabled children are affected by cerebral palsy. In India,the estimated incidence is around 3/1000 live births. Diplegic is the commonest form at 30%-40%,hemiplegia is 20%-30% and quadriplegia accounts for 10%-15%.In an analysis of 1000 cases of CP from India, It was found that spastic quadriplegia constituted 61% of cases followed by diplegia 22%.Spastic CP is the commonest and accounts for 70%-75% of all cases, dyskinetic for 10% to 15% and ataxic for less than 5% of cases.[6]

❖ **MK FRANKLIN SHAJU,et al., (2016):**

According to World Health Organization (WHO) estimation, 3.8% of the Indian children have some form of disability due to different causes. Among that nearly 15-20% was suffering from cerebral palsy (CP), Spastic Diplegic accounts for 22.4 %. The estimated incidence of cerebral palsy in India is around 3/1000 live births. However, being a developing country, the expected actual figure may be much higher. An experimental study was conducted to evaluate and compare the efficacy of task oriented training and conventional physiotherapy on mobility and balance among spastic Diplegic cerebral palsy children.[17]

2.2 REVIEW RELATED TO AETIOLOGY

❖ **TAYLOR et al., (2005)**

In about 10-20% of patients, cerebral palsy is acquired postnataly, mainly because of brain damage from bacterial meningitis, viral encephalitis, hyperbilirubinemia, motor vehicle collisions, falls or child abuse.

❖ **DAMMANN et al., (2004)**

In addition to prematurity and low birth weight, other disorders that have been implicated include multiple gestation, intrauterine viral infection, male gender, hereditary, fetal blood clotting disorders, placental abnormalities, and signs of intrauterine infection or inflammation.

2.3 REVIEW RELATED TO IMPAIRMENT IN GROSS MOTOR FUNCTIONS

- **ABDEL-AZIEM AA[1], EL-BASATINY HM(2017):**

A total of 30 children with hemi paretic cerebral palsy of both sexes (10 to 14 years of age, classified as I or II by gross motor function classification system) participated in this study. They were randomly assigned into two equal groups.Both groups received a conventional physical therapy program for 12 successive weeks (three sessions per week). The experimental group additionally received (25 min) backward walking training. The control group additionally received (25 min) forward walking training.

2.4 REVIEW RELATED TO OUTCOME MEASURES

MODIFIED TIMED UP AND GO TEST:

- **MK FRANKLIN S.(2016)**

Twenty spastic Diplegic cerebral palsy children were selected for the study and divided into two groups one group received task oriented training and the other group received conventional physiotherapy daily one hour and the same was continued for six weeks. Before starting the treatment mobility and balance were measured by timed up and go test and pediatric balance scale respectively. The measurements were repeated after six weeks.

- **SANJIVANI N,et al., (2012)**

Studied on reliability of modified timed up and go test in children with cerebral palsy.The study was conducted on 30 cerebral palsy childrenon 4-12 years.Three trails were conducted for each of the three occasionsinitial assessment(time 1),30 minutes after initial assessment(time 2),and 1 week after initial assessment (time 3).The mean score of three trials was documented as the final score.Results reveals that the reliability of TUG test was high,with ICC of 0.99 for within-session reliability and 0.99 for test-retest reliability.

GROSS MOTOR FUNCTIONAL MEASURE (GMFM):

- **ABDEL-AZIEM AA[1], EL-BASATINY HM(2017)**

A total of 30 children with hemiparetic cerebral palsy of both sexes (10 to 14 years of age, classified as I or II by gross motor function classification system) participated in this study. They were randomly assigned into two equal groups.Both groups received a conventional physical therapy program for 12 successive weeks (three sessions per week). The experimental group additionally received (25 min)

backward walking training. The control group additionally received (25 min) forward walking training.

- **KIM SGet.al., (2013)**

The study was to determine whether an 8-week period of backward walking (BW) training on the treadmill can improve the gross motor function measure (GMFM), weight-bearing symmetry, and temporospatial gait parameters in individuals with spastic cerebral palsy. Twelve participants aged 5-15 years with spastic cerebral palsy participated in this study. The BW training was conducted on a treadmill for up to 20 min, with three sessions per week for 8 consecutive weeks. Before each treadmill training session, lower limb stretching was included in the session.

PAEDIATRIC BALANCE TEST:

- **MK FRANKLIN S.(2016)**

Twenty spastic Diplegic cerebral palsy children were selected for the study and divided into two groups one group received task oriented training and the other group received conventional physiotherapy daily one hour and the same was continued for six weeks. Before starting the treatment mobility and balance were measured by timed up and go test and pediatric balance scale respectively. The measurements were repeated after six weeks.

- **CHANDAN KUMAR,et.al.,(2013):**

Conducted study on effectiveness of task oriented circuit training on functional mobility and balance in cerebral palsy.This was an experimental study of 30 children with spastic diplegic cerebral palsy.All the subjects were enrolled in an identical sub group and divided into two equal groups(15 patient in each group) one experimental group and other control group. Experimental group did task oriented circuit training while control group performed conventional exercise program. The functional mobility of lower extremity and balance of all patients are assessed by Timed Up and Go test and paediatric balance scale.The study concluded that task oriented circuit training is more effective as compared to the conventional training for the functional mobility and balance in spastic diplegic cerebral palsy children.

- **YI SH.et.al.,(2012):**

Conducted study on validity of paediatric balance scale in children with spastic cerebral palsy.Paediatric berg balance scale is modified version of berg balance scale.In this study total of 38 children with spastic CP who could ambulate

participated in this study and this study concluded that paediatric balance scale can be considered as a simple,valid scale for examining functional balance capacity in children with spastic cerebral palsy.

2.5 REVIEW RELATED TO INTERVENTION

BODY WEIGHT SUPPORTED TREADMILL TRAINING:

- **ABDEL-AZIEM AA[1], EL-BASATINY HM(2017):**

A total of 30 children with hemiparetic cerebral palsy of both sexes (10 to 14 years of age, classified as I or II by gross motor function classification system) participated in this study. They were randomly assigned into two equal groups.Both groups received a conventional physical therapy program for 12 successive weeks (three sessions per week). The experimental group additionally received (25 min) backward walking training. The control group additionally received (25 min) forward walking training.

- **AYOUB, H. (2016)**

Children were asked to walk backward with suspension held on the treadmill with body weight support (30% body weight release) with speed of 0.01 m/sec. and 0 degree inclination for 5 min. firstly increased gradually to reach 2m/ sec. for total time of session 15 min., totally. Partial body weight supported backward treadmill training was conducted once a day, 3 sessions a week for 3 months.

- **HAMADA EI SAYED ABD ALLAH AYOU B et.al.,(2015):**

He did the study on impact of body weight supported backward treadmill training on walking speed in children with spastic diplegia.Twenty children with spastic diplegia enrolled in the study, they were classified into two groups of equal number.The control group (A) received selected physicaltherapy program based on the neurodevelopmental approach for such cases,while the study group(B) received partial body weight supported backward treadmill training in addition to regular exercise program.Gait pattern was associated using the Biodex Gait trainer II for each group pre and post three months of the treatment program.There was statistically significant improvement in the walking speed in the study group($p<0.05$)with significant difference when compared post treatment results between groups($P<0.05$).These findings suggested that the partial body weight supported backward treadmill training can be included as a supplementary therapeutic modality

to improve walking speed and functional abilities of children with diplegic cerebral palsy.

- **TOSHIFUMI TAKAO, et.al.,(2015):**

They did study on improvement of Gait ability with a short term intensive gait rehabilitation program using body weight support treadmill training in community dwelling chronic stroke survivors.In this study the treatment group received BWSTT 3 times a week for 4 weeks (a total of 12 times)with each session lasting 20 minutes. The main outcome measures were maximum gait speed on flat floor, cadence and step length. No difference was observed in the baseline clinical data between the 2 groups. The gait speed in the treatment group was significantly improved compared with that in the control by 2-way ANOVA, while the other parameters showed no significant interaction.The study concluded that short term intensive gait rehabilitation using BWSTT was improving gait ability among community dwelling post stroke subjects.

- **KIM SGet.al., (2013)**

The study was to determine whether an 8-week period of backward walking (BW) training on the treadmill can improve the gross motor function measure (GMFM), weight-bearing symmetry, and temporospatial gait parameters in individuals with spastic cerebral palsy. Twelve participants aged 5-15 years with spastic cerebral palsy participated in this study. The BW training was conducted on a treadmill for up to 20 min, with three sessions per week for 8 consecutive weeks. Before each treadmill training session, lower limb stretching was included in the session.

CHAPTER III

MATERIALS AND METHODOLOGY

3.1 STUDY DESIGN:

The study design was an Experimental design with pre and post test evaluation was done.

3.2 STUDY POPULATION:

Subjects with spastic diplegic cerebral palsy were enrolled for this study.

3.3 SAMPLE SIZE:

24 children with spastic diplegic cerebral palsy who fulfill the selection criteria were selected for this study.

3.4 SAMPLING TECHNIQUE:

Children were selected by using probability sampling method and they were divided into two groups by using toss method.

3.5 STUDY SETTING:

The study was conducted at out-patient department of PPG College of Physiotherapy and Ashwin Hospital, Coimbatore.

3.6 STUDY DURATION:

The total study duration was six weeks. Enrollment period was from November 2018 to December 2018.

3.7 SELECTION CRITERIA:

3.7.1 INCLUSION CRITERIA

- Age between 5 to 12 years old.
- Both males and females.
- Spastic diplegia cerebral palsy.
- The Gross Motor Functional Classification System level-II.
- Subjects who can follow the treatment instruction.

3.7.2 EXCLUSION CRITERIA

- All other types of cerebral palsy.
- Selective dorsal rhizotomy, botulinum injection to the lower extremity within 6 months.
- Any orthopedic problems or medical conditions that prevent children from participating in the exercise.

- Children who cannot participate in the exercise program due to contractures and deformities.
- Children with cardiac problems like congenital and rheumatic heart diseases.
- Children who are having visual and hearing deficits.

3.8 MATERIALS:

- Informed consent form
- Assessment Chart
- Gross Motor Functional Classification System
- Body weight support treadmill
- Stop watch
- Measurement tape
- Chairs
- Mats
- Gross Motor Function Measure version 88
- Pediatric Berg Balance Scale

3.9 PARAMETERS

GMFM – Walking Dimension

Balance – Pediatric Berg Balance Scale

Functional Mobility – Modified timed get up and go test.

3.10 PROCEDURE:

The need and objectives of the study were clearly explained to the ethical committee of PPG college of Physiotherapy and permission was obtained. Then the study was conducted at out-patient department of PPG College of Physiotherapy and Ashwin Hospital, Coimbatore.

28 children with spastic diplegic cerebral palsy were screened for the study on that 24 subjects who come under selection criteria were selected for this study. The parents of the children were received clear explanation in detail about the need of the mobility function in cerebral palsy, intervention procedure and merits and demerits of the study. After that they were asked to submit the written informed consent form.

All the selected subjects were evaluated before staring study. 24 Children were randomly allocated into two groups by using toss method. The subjects in group A were consisting of 12 subjects and they were treated with forward body weight supported treadmill training. The subjects in group B were consisting of 12 subjects

and they were treated with backward body weight supported treadmill training. Along with that both the group children received routine physiotherapy and occupational therapy treatment.

Both the groups were received intervention for 30 minutes per session, 5 days in a week for a period of 6 weeks. The pre and post score values of balance and functional mobility were measured by using GMFM standing dimension, GMFM walking dimension, Modified timed get up and go test and Pediatric Berg balance scale. The values were recorded and documented.

3.11 TECHNIQUE:

- Group A - Forward body weight supported treadmill training along with conventional physiotherapy.
- Group B - Backward body weight supported treadmill training along with conventional physiotherapy.

TREADMILL PROCEDURE:

FORWARD AND BACKWARD WALKING PROGRAM:

Participant in the Group-A child are asked or assisted to stand upright in the Treadmill. The treadmill speed at the first session was determined by starting the treadmill at the lowest speed and gradually increasing to aspeed at which the child stepped forward comfortably (0.1kphincrements). Treadmill speed was increased during each walking session as tolerated, and at subsequent sessions the child began walking at the maximum speed recorded at the previous session. The trainer provided assistance with components of the gait cycle .A mirror was positioned in front of the treadmill to provide the child with feedback on postural alignment and to assist motivation.

Participants in the Group-B asked or assisted to stand upright in the Treadmill. The treadmill speed at the first session was determined by starting the treadmill at the lowest speed and gradually increasing to a speed at which the child stepped backward comfortably (0.1kphincrements). Treadmill speed was increased during each walking session as tolerated, and at subsequent sessions the child began walking at the maximum speed recorded at the previous session. The trainer provided assistance with components of the gait cycle. A mirror was positioned in front of the treadmill to provide the child with feedback on postural alignment and to assist motivation.

The Physiotherapist provided facilitation of components of the gait cycle as described for the both groups. At each training session, children were encouraged to walk faster and for a longer duration than the previous training session.

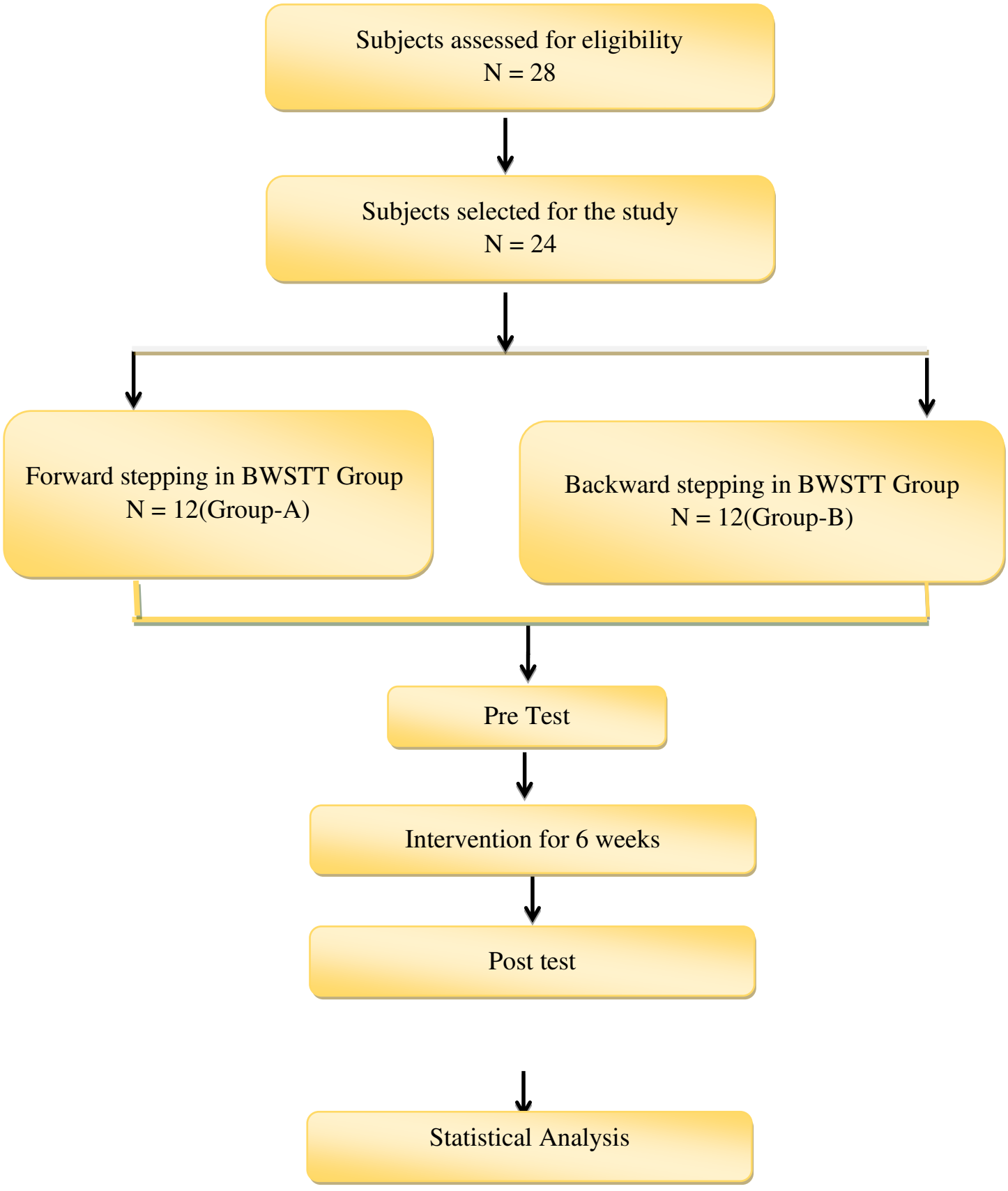
Both groups walked for a maximum of 30 minutes. Sessions ceased earlier if the children indicated a desire to stop or when they stopped actively stepping. All children wore their usual footwear and orthoses during training. A log book was used to record the duration of training, distance walked, treadmill speed and use of orthoses, and details of any adverse events.

Throughout the program, participants continued with their usual conventional physiotherapy program. Each participant's program remained constant prior to, during, and after the training period. Parents and guardians were requested not to initiate any additional interventions, not to have the children perform any treadmill walking on their own, and not to increase the usual intensity of the children's walking practice during the trial.

CONVENTIONAL PHYSIOTHERAPY:

The conventional treatment was given for 6 weeks, single session daily. outcomes were measured on the first and last day of treatment. The conventional treatments were passive, active movements and stretching to both upper ,lower limbs and trunk region.

RESEARCH FLOW CHART



CHAPTER IV

DATA ANALYSIS AND RESULT

4.1 Statistical Tool:

The data were statistically analyzed using following test.

1.PAIRED 't'-TEST

The paired t-test was used to find out the statistical significance between pre and post t-test values of GMFM Score, MTUGT Walking Phase Score, Pediatric Balance Scale Score before and after training for Group A and Group B.

FORMULA FOR PAIRED t -TEST,

$$S = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

d = difference between the pre-test V_s post test

$\bar{d}$ = Mean difference

n = Total number of subjects

S = Standard deviation

2.UNPAIRED 't'- TEST

The unpaired t-test was used to compare the statistically significance difference of GMFM Score, MTUGT Walking Phase Score, Pediatric Balance Scale Score before and after training for Group A and Group B.

FORMULA FOR UNPAIRED t –TEST,

$$S = \sqrt{\frac{(n_1-1){s_1}^2+(n_2-1){s_2}^2}{n_1+n_2-2}}$$

$$t = \frac{|\bar{x}_1-\bar{x}_2|}{s\sqrt{\frac{1}{n_1}+\frac{1}{n2}}}$$

n_1 = Total number of subject in group A

n_2 = Total number of subject in group B

x_1 = Difference between pre- test and post -test of Group A

$\overline{x_1}$ = Mean difference between pre test and post test of group A

X_2 = Difference between pre- test and post- test of Group B

$\bar{X}_2$ = Mean difference between pre- test and post- test of Group B

S = Standard Deviation

4.2 DEMOGRAPHICAL DATA

CHARACTERISTICS	**GROUP-A (N=12)**	**GROUP-B (N=12)**
AGE	10.35±3.14	11.24±4.17
GENDER (MALE/FEMALE)	6/6	5/7
HEIGHT	132.45±23.97	133.39±21.47
WEIGHT	33.44±16.72	32.14±19.23
GMFCSII	7	6

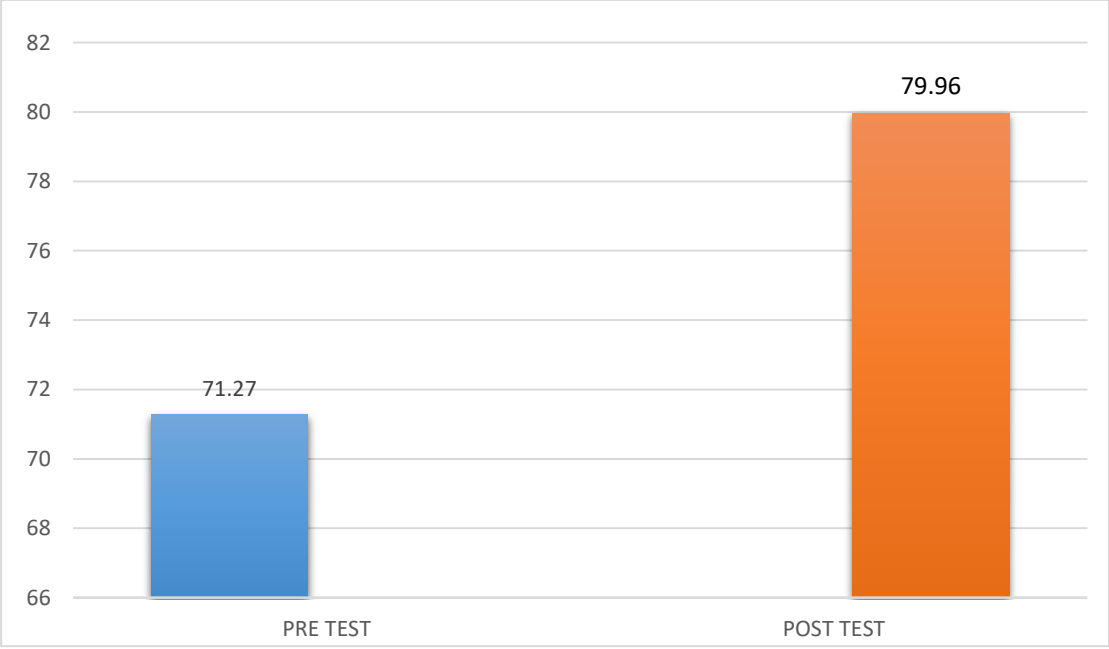
Table no;I Demographical Data

Table II: STATISTICAL ANALYSIS OF PRE AND POST GMFM SCORES OF GROUP A

Test	Mean	Standard Deviation	T value	P value
PRE	71.27	4.073	-6.20106	<.05
POST	79.96	3.87		

In the statistical analysis of pre and post GMFM scores of group A, the mean values of GMFM scores of pre test data was 71.27 and that of post test data was 79.96. T value obtained was -6.20106, P value was <.05. The post test score was significantly different from the pre-test scores.

Data analysis shows significant improvement in gross motor functions of Group A. This results due to the cumulative effect of forward stepping strategy of bodyweight treadmill training and conventional physiotherapy.



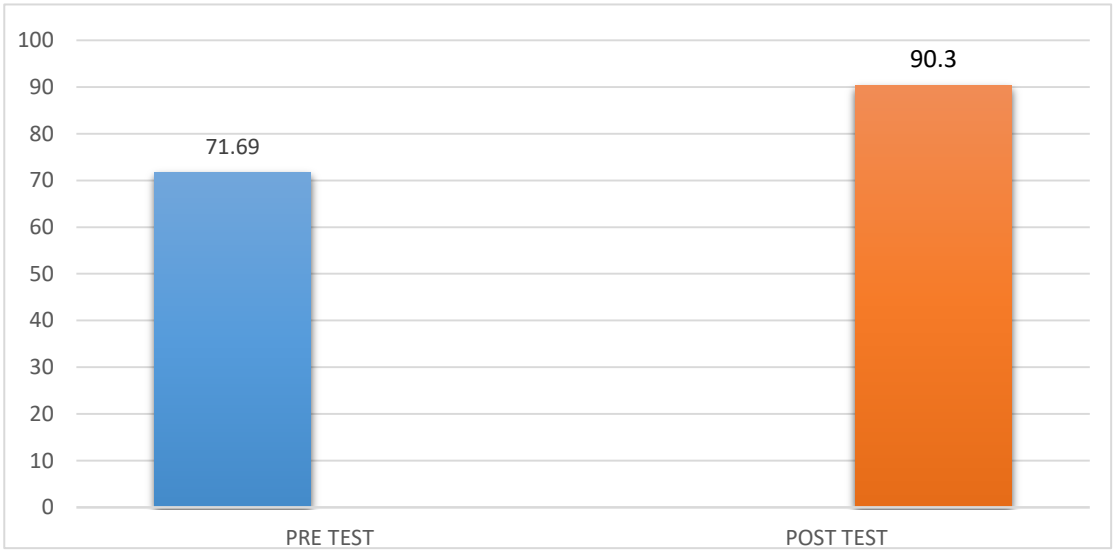
Graph no I: Graphical Representation of pre and post GMFM scores of group A

Table III: STATISTICAL ANALYSIS OF PRE AND POST TEST GMFM SCORE OF GROUP B

Test	Mean	Standard Deviation	T value	P value
PRE	71.69	4.94	-10.68867	<.05
POST	90.30	3.47		

In the statistical analysis of pre and post GMFM scores of group B, the mean values of GMFM scores of pre test data was 71.69and that of post test data was 90.30. T value obtained was -10.68867, P value was <.05. The post test score was significantly different from the pre-test scores.

Data analysis shows significant improvement in gross motor functions of Group B. This results due to the cumulative effect of Backward stepping Strategy of bodyweight treadmill training and conventional physiotherapy.



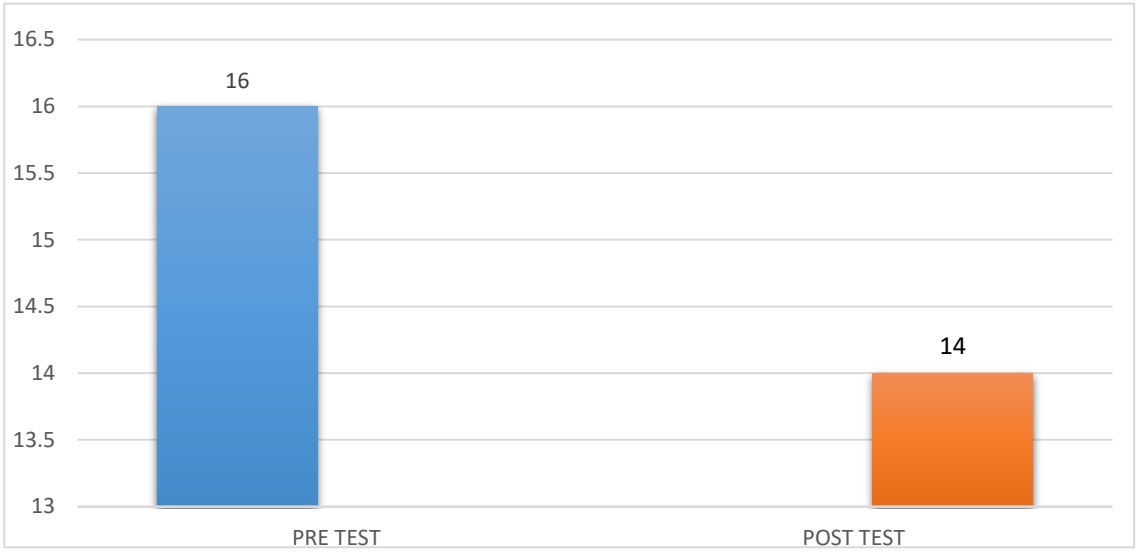
Graph no II: Graphical Representation of pre and post test GMFM score of group B

Table IV: STATISTICAL ANALYSIS OF PRE AND POST TEST MTUGT WALKING PHASE SCORE OF GROUP A

Test	Mean	Standard Deviation	T value	P value
PRE	16	0.95	4.50641	<.05
POST	14	1.21		

In the statistical analysis of pre and post MTUGT Walking Phase scores of group A, the mean values of MTUGT Walking Phase scores of pre test data was 16 and that of post test data was 14. T value obtained was 4.50641, P value was <.05. The post test score was significantly different from the pre-test scores.

Data analysis shows significant improvement in functional mobility of Group A. This results due to the cumulative effect of forward stepping Strategy of bodyweight treadmill training and conventional physiotherapy.



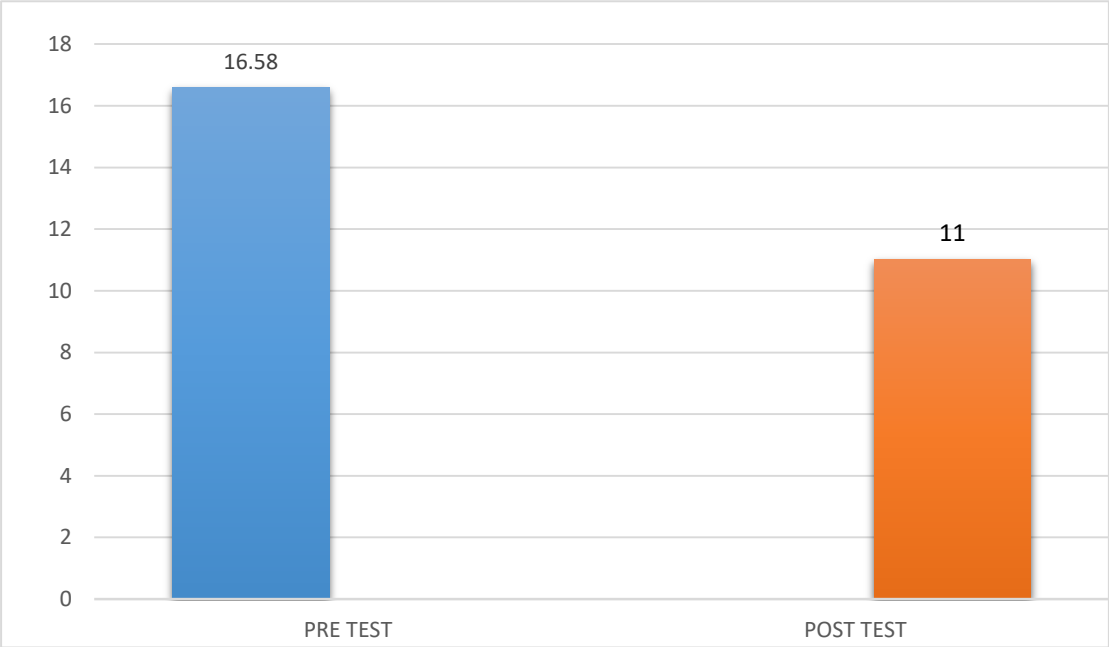
Graph no III:Graphical Representation of pre and post test MTUGT walking Phase score of group A

Table V:STATISTICAL ANALYSIS OF PRE AND POST TEST MTUGT WALKING PHASE SCORE OF GROUP B

Test	Mean	Standard Deviation	T value	P value
PRE	16.58	1.08	12.36431	<.05
POST	11.00	2.04		

In the statistical analysis of pre and post MTUGT scores of group B, the mean values of MTUGT scores of pre test data was 16.58and that of post test data was 11.00. T value obtained was 12.36431, P value was <.05. The post test score was significantly different from the pre-test scores.

The data analysis shows significant improvement in functional mobility in Group B. This result due to the effect of Backward stepping Strategy of bodyweight treadmill training and conventional physiotherapy.

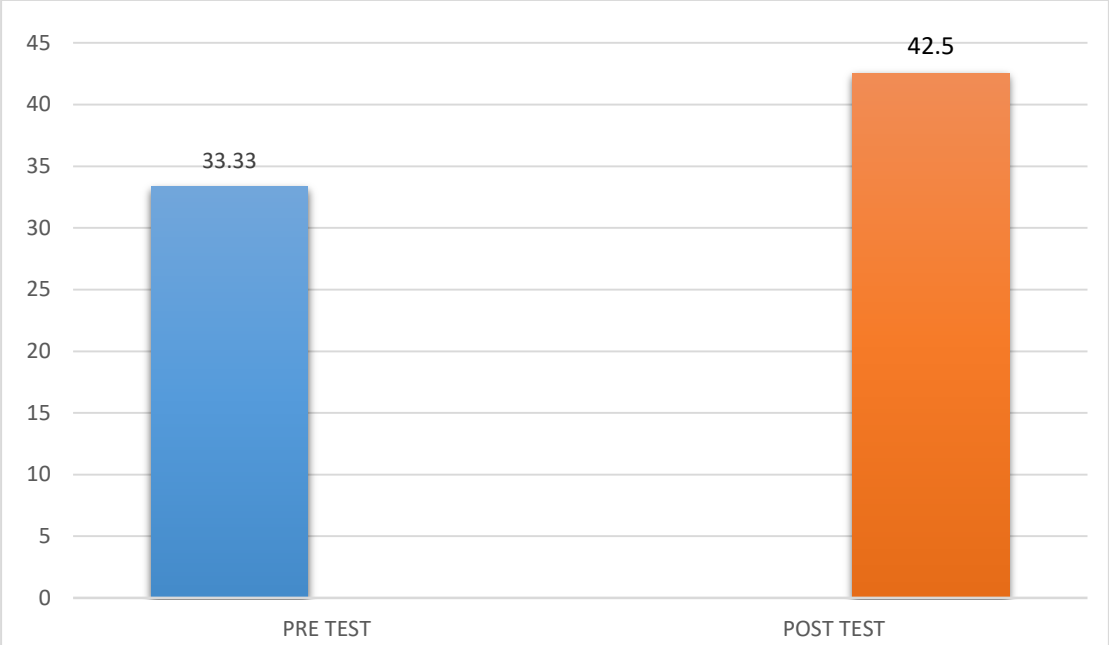


Graph no IV : Graphical Representation of pre and post test MTUGT walking phase score of group B

Table VI: STATISTICAL ANALYSIS OF PRE AND POST TEST PEDIATRICS BALANCE SCALE SCORE OF GROUP A

Test	Mean	Standard Deviation	T value	P value
PRE	33.33	3.20	13.868707	<.05
POST	42.50	2.87		

In the statistical analysis of pre and post PBS scores of group A , the mean values of PBS scores of pre test data was 33.33and that of post test data was 42.50. T value obtained was 13.868707, P value was <.05. The post test score was significantly different from the pre-test scores.

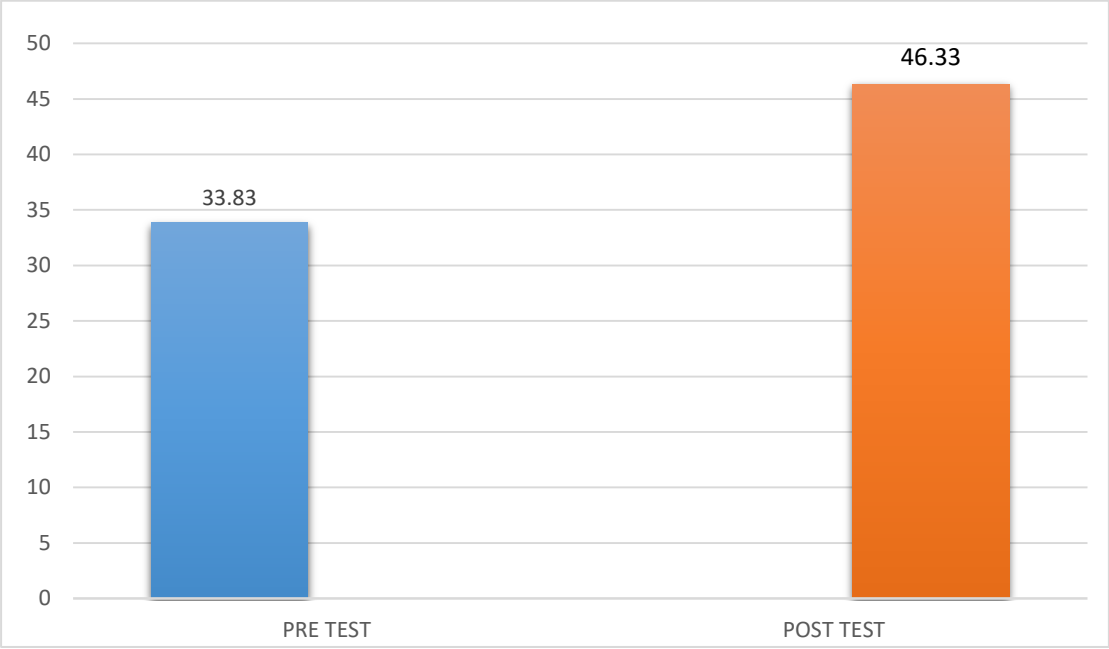


Graph no V: Graphical Representation of pre and post test Pediatrics balance scale score of group A

Table VII: STATISTICAL ANALYSIS OF PRE AND POST TES T PEDIATRICS BALANCE SCALE SCORE OF GROUP B

Test	Mean	Standard Deviation	T value	P value
PRE	33.83	3.38	-7.50341	<.05
POST	46.33	4.68		

In the statistical analysis of pre and post PBS scores of group B, the mean values of PBS scores of pre test data was 33.33and that of post test data was 46.08. T value obtained was -7.50341, P value was <.05. The post test score was significantly different from the pre-test scores.



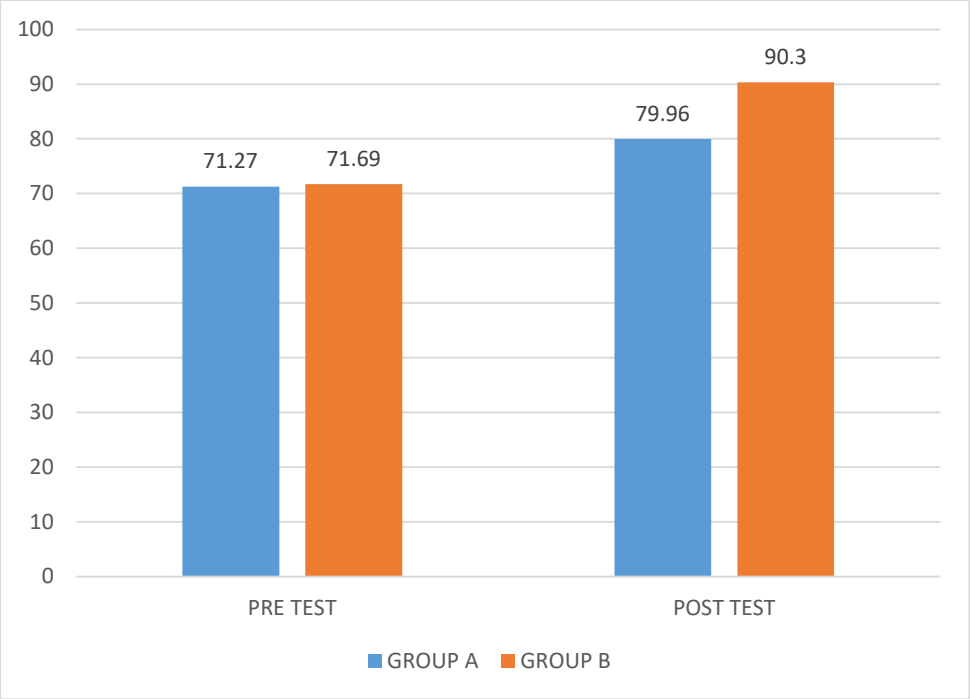
Graph no VI: Graphical Representation of pre and post test Pediatrics balance scale score of group B

Table VIII: STATISTICAL ANALYSIS OF GMFM BETWEEN GROUP A AND B-GMFM

TEST	GROUP	MEAN	STANDARD DEVIATION	T-VALUE	P-VALUE
PRE TEST	**GROUP-A**	**71.27**	**4.073**	**0.09111**	>.05
	GROUP-B	**71.69**	**4.94**		
POST TEST	**GROUP-A**	**79.96**	**3.87**	**6.88407**	<.05
	GROUP-B	**90.30**	**3.47**		

In the statistical analysis of pre test values of both group A and group B were calculated. The pre mean values of GMFM for both groups were 71.27 and 71.69. The T-value was 0.09111the obtained t-value is lesser than the table value. and the P-value showed there were no significant in pre test comparison.

The post test mean values of GMFM for both groups were 79.96 and 90.30.The T-value was 6.88407,the obtained t-value is greater than the table value. and the P-value showed there were significant in post test comparison. Alternative hypothesis was accepted.



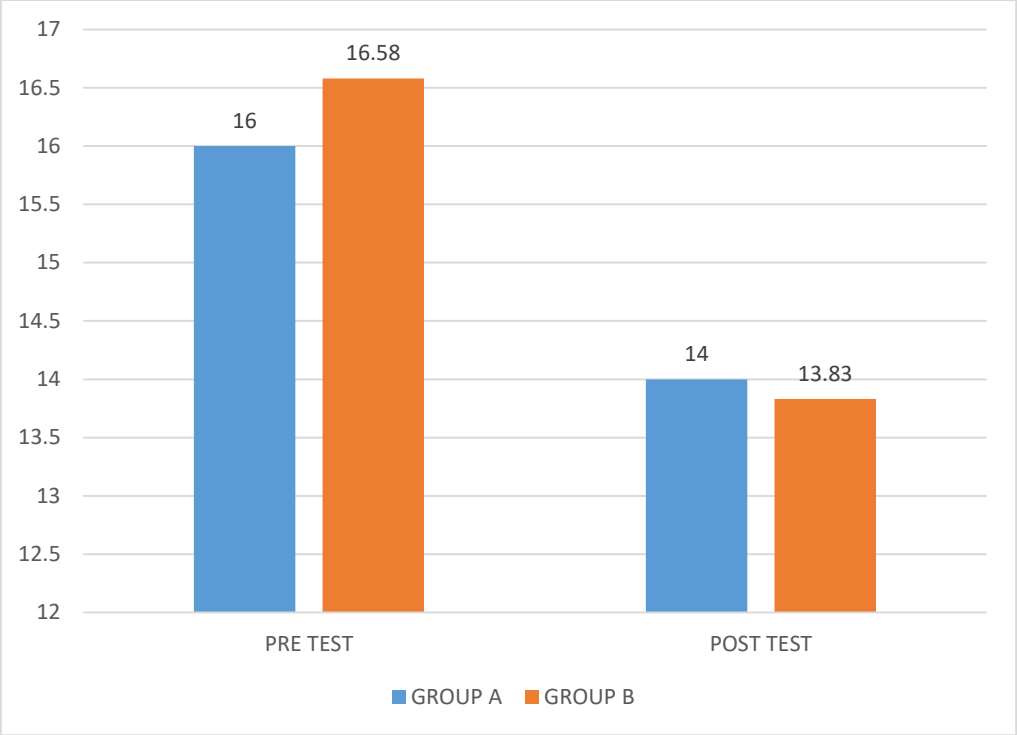
Graph no VI: Graphical Representation of GMFM Score between Group A and Group B

Table VIII: STATISTICAL ANALYSIS OF MTUGT BETWEEN GROUP A AND GROUP B

TEST	GROUP	MEAN	STANDARD DEVIATION	T-VALUE	P-VALUE
PRE TEST	**GROUP-A**	**16**	**0.95**	**1.4**	>.05
	GROUP-B	**16.58**	**1.08**		
POST TEST	**GROUP-A**	**14**	**1.21**	**4.24**	<.05
	GROUP-B	**13.83**	**1.19**		

In the statistical analysis of pre test values of both group A and group B were calculated. The pre mean values of MTUGT for both groups were 16.00 and 16.58. The T-value was 1.4 the obtained t-value is lesser than the table value. and the P-value showed there were no significant in pre test comparison.

The post test mean values of MTUGT for both groups were 14 and 13.83.The T-value was 4.24,the obtained t-value is greater than the table value. and the P-value showed there were significant in post test comparison. Alternative hypothesis was accepted.



Graph no VI: Graphical Representation of MTUGT Score between Group A and Group B

Table VIII: STATISTICAL ANALYSIS OF PBS BETWEEN GROUP A AND GROUP B

TEST	GROUP	MEAN	STANDARD DEVIATION	T-VALUE	P-VALUE
PRE TEST	**GROUP-A**	**33.33**	**3.20**	**0.3721**	>.05
	GROUP-B	**33.83**	**3.38**		
POST TEST	**GROUP-A**	**46.08**	**3.60**	**2.38967**	<.05
	GROUP-B	**46.33**	**4.68**		

In the statistical analysis of pre test values of both group A and group B were calculated. The pre mean values of PBS for both groups were 33.33 and 33.38. The T-value was 0.3721 the obtained t-value is lesser than the table value. and the P-value showed there were no significant in pre test comparison.

The post test mean values of PBS for both groups were 46.08 and 46.33.The T-value was 2.38967,the obtained t-value is greater than the table value. and the P-value showed there were significant in post test comparison. Alternative hypothesis was accepted.

.Graph no VI: Graphical Representation of PBS Score between Group A and Group B

CHAPTER V

DISCUSSION

CHRISTINE THOROGOOD stated that spastic diplegic accounts about nearly one-third of all spastic cerebral palsied cases as a result of cerebral lesion in the brain.

JOOYEON KO, In his study, 11 pediatric physical therapists initiallyexamined the inter-rater reliability of the GMFCS based onvideo recordings. To investigate intra-rater reliability, anexpert PT and a newly trained PT rescored the same videoclips one month after the inter-rater reliability assessment.Watkins and Portney[20] reported that an ICC ≥ 0.90 indicatesa high reliability, 0.75–0.90 indicates good reliability, 0.50–0.75 indicates moderate reliability, and ≤ 0.50 indicatespoor reliability. Our results indicate that the ICC for theeleven GMFCS raters was high in all age groups. The intra-rater reliability of newly trained PT, rater B, and expert PT,rater K were also high

In my study 24 Cerebral Palsy subjects mainly spastic diplegic who were recruited and randomly allocated based on the selection criteria GMFCS-level-II into forward walking in body weight support treadmill training group A (n=12) and backward walking body weight support treadmill training group B (n=12). After the six weeks of intervention, the group B subjects showed statistically significant improvement in the gross motor functional measure scale, modified timed up and go test and pediatric balance scale when compared to the group A subjects.

Another one author named HAMADA EL did the study on forward versus backward bodyweight supported treadmill training on step symmetry in children with spastic diplegia. In his study 20 childrens with spastic diplegic from both sexes, they were classified into two groups of equal numbers. The first group A received partial bodyweight supported backward treadmill training in addition to regular exercise program while the second group B received partial bodyweight supported treadmill training in addition to regular exercise program. Gait pattern was assessed using biodex gait trainer II for both groups before and after three months of treatment. In his studies, partial bodyweight supported treadmill training with backward gait training to improve steps symmetry than forward gait training of spastic diplegic children.

HOPPER T.L.et al., did the study on the effects of graded forward and backward walking on heart rate and oxygen consumption. In his study, backward

walking effective to improve the patient balance, proprioception and the lower limb muscle activity. Also, it will improve speed of the walking.

KIM SG et al., did the study on to determine whether an 8-week period of backward walking (BW) training on the treadmill can improve the gross motor function measure (GMFM), weight-bearing symmetry, and temporospatial gait parameters in individuals with spastic cerebral palsy. Twelve participants aged 5-15 years with spastic cerebral palsy participated in this study. The BW training was conducted on a treadmill for up to 20 min, with three sessions per week for 8 consecutive weeks. Before each treadmill training session, lower limb stretching was included in the session. Interlimb differentials of vertical ground reaction force while standing, temporal-distance gait parameters, and scores of dimension D and dimension E of the GMFM were determined. Participants showed statistically significant improvements in a measure of GMFM ($P<0.01$) and weight-bearing symmetry value ($P<0.05$), forward walking velocity ($P<0.05$), and step/stride length ($P<0.05$ or $P<0.01$). This pilot study suggests that BW therapy on a treadmill may help to improve walking abilities and other gross motor skills in this sample of patients.

ABDEL-AZIEM AA, EL-BASATINY HM did the study on Effectiveness of backward walking training on walking ability in children with hemiparetic cerebral palsy: To compare the effects of backward walking training and forward walking training on spatiotemporal gait parameters, and gross motor function measures in children with cerebral palsy. A total of 30 children with hemiparetic cerebral palsy of both sexes (10 to 14 years of age, classified as I or II by gross motor function classification system) participated in this study. They were randomly assigned into two equal groups. Both groups received a conventional physical therapy program for 12 successive weeks (three sessions per week). The experimental group additionally received (25 min) backward walking training. The control group additionally received (25 min) forward walking training. Baseline, posttreatment, and follow-up assessment for spatiotemporal gait parameters and gross motor functions were evaluated by using three dimensional gait analysis system and gross motor function measures. There was a significant improvement in step length, walking velocity, cadence, stance phase, and swing phase percentage and gross motor function measures (Dimensions D and E) of the experimental group (0.55 ± 0.16, 0.53 ± 0.19, 121.73 ± 2.89, 54.73 ± 1.67, 44.40 ± 1.40, 90.20 ± 6.44, 82.47 ± 12.82), respectively, than the control group

(0.39 ±0.13, 0.46 ±0.20, 125.80 ±2.96, 50.27 ±1.62, 49.47 ±1.55, 82.47 ±7.05, 80.47 ±12.61), respectively, ($p < 0.05$). The significant improvement of all measured outcomes of the experimental group was maintained at 1 month follow-up assessment ($p < 0.05$).In his study they concluded,iIn addition to a conventional physical therapy program, backward walking training is more effective than forward walking training on spatiotemporal gait parameters, and gross motor function measures in children with hemiparetic cerebral palsy.

In my present study, subject in control group A were given forward walking bodyweight supported treadmill training in addition with regular exercise program. Afterward, subject in experimental group B were given backward walking bodyweight supported treadmill training in addition to regular exercise program on gross motor function, functional mobility and balance in children with spastic diplegia.The statistical report indicates that there was a significant improvement seen in GMFM score, MTUG score, and PBS after the application of six weeks intervention. So, the backward walking treadmill training with bodyweight support is the effective treatment technique than forward walking treadmill training with bodyweight support to improve gross motor function, functional mobility and balance among subject with spastic diplegic children.

CHAPTER VI

SUMMARY AND CONCLUSION

6.1 SUMMARY:

The study was conducted to investigate the effectiveness of forward (group A) - control group consisting of 12 subjects versus backward (group B) - experimental group consisting of 12 subjects stepping strategy in bodyweight support treadmill training on functional mobility and balance among spastic diplegic..

Both the groups received intervention for 30 minutes per session, five days in a week for six weeks along with their routine physiotherapy.

6.2 CONCLUSION:

The study proves that six weeks of backward walking body weight support treadmill training program with regular exercise program showed statistically significant improvement in gross motor function, functional mobility when compared to forward walking body weight support treadmill training program with regular exercise.

CHAPTER VII

LIMITATIONS AND SUGGESTIONS

LIMITATIONS

1. Sample size was small, which reduces the generalize ability.
2. Duration of treatment program was only 6 weeks.
3. Only children with limited severity and diagnosis participated in the study.
4. The study assessed only short term progress of the patient. Long term follow up is needed to evaluate the differences in the condition of the patients from current status.
5. No follow up could be done to determine whether the effect was maintained.

SUGGESTIONS:

1. Further study can be conducted with more sample size.
2. Further studies can be done in other different type of cerebral palsy children and with various severities of CP.
3. Further studies are recommended with a longer duration of treatment program.
4. Further studies should be undertaken with the similar patient group to confirm the findings of the study.
5. Further study can be conducted with other GMFCS levels of cerebral palsy.

CHAPTER VIII

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CHAPTER IX

ANNEXURE I

INFORMED CONSENT FORM

TITLE:"EFFECTIVENESS OF FORWARD VERSUS BACKWARD STEPPING STATERGY IN BODY WEIGHT SUPPORT TREADMILL TRAINING ON FUNCTIONAL MOBILITY AND BALANCE AMONG SPASTIC DIPLEGIC CEREBRAL PALSY"

INVESTIGATOR: Mr. RAJKUMAR

CO-INVESTIGATOR: DR.M. PRADEEPA

PURPOSE OF THE STUDY:

I _____ have been informed that this study will help clinicians & therapists to find out the**EFFECTIVENESS OF FORWARD VERSUS BACKWARD STEPPING STATERGY IN BODY WEIGHT SUPPORT TREADMILL TRAINING ON FUNCTIONAL MOBILITY AND BALANCE AMONG SPASTIC DIPLEGIC CEREBRAL PALSY**

PROCEDURE:

I _____ understand that Iwill undergo experiment with Mr. Rajkumar / Dr.M.Pradeepa under the direct supervision of the physiotherapist. I am aware that I have to follow therapist's instruction as has been told to me.

RISKS AND DISCOMFORT:

I _____ understand that there are no potential risks associated with this procedure, and understand that Mr. Rajkumar/Dr.M.Pradeepa will accompany me during this procedure. There are no known hazards associated with this procedure.

CONFIDENTIALITY:

I _____ understand that the medical information produced by this study will be confidential. If the data are used for publication in the medical literature or for teaching purpose, no names will be used. And photographs, audio and videotapes will be used without identity for publication and presentation.

PHOTOGRAPHY CONSENT:

Mr. Rajkumar/Dr.M.Pradeepa have been explained to me that photography are required in order to illustrate various aspects of the study for the thesis and at the presentation or conference by giving my consent.

I _____ authorize Mr. Rajkumar/Dr.M.Pradeepa to use any of the photography taken of me in printed format, in slides for presentation.

REQUEST FOR MORE INFORMATION:

I _____ understand that I ask any questions about the study at any time Mr.Rajkumar/Dr.M.Pradeepaare available to answer my question. Copy of this concern form will be given to me keep for my careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I _____ understand that my participation is voluntary and I may withdraw consent and discontinue participation at any time after he has explained the reasons for doing so.

INJURY STATEMENT:

I understand that the treatment procedure, under the guidance of my therapist, is likely to cause any / no injury. In such case medical attention will be provide, but no compensation will be provided. I understand my agreement to participate in this study and I am not waiving any of my legal rights.

I _____ confirm that Mr. Rajkumar/Dr.M. Pradeepa have explained me the purpose of the study, the study procedure and possible risk that I may experience.

I have read and I have understood this concern to participate as a subject in this study.

_____ _____

SUBJECT **DATE**

_____ _____

WITNESS TO SIGNATURE **DATE**

I have explained _____the purpose of the research, the procedure required and the possible risks and benefits, to the best of my ability.

_____ _____

INVESTIGATOR **DATE**

1. **MR. RAJKUMAR**
2. **Dr.M.PRADEEPA**

ANNEXURE II

ASSESSMENT CHART

SUBJECTIVE ASSESSMENT: **DATE:**

Name:

Age:

Gender:

Occupation:

Address:

CHIEF COMPLAINTS:

HISTORY TAKING:

PRESENT MEDICAL HISTORY:

PAST MEDICAL HISTORY:

PERSONAL HISTORY:

FAMILY HISTORY:

1.History of similar illness(or) any other relevant illness.

(a) Yes b)No c) Do not know

Parents/Siblings/Maternal side/Parental side

2. Consanguinity:

(a) Absent

(b) 1st degree

(C) 2 nddegree

(d) 3 rddegree

3.Age of mother at child birth(years):

4.Baby born after how many years of marriage :

5.Birth history:

a) Gravida b) Parity c) Abortions

PARENTAL HISTORY:

1. Did mother have any of the following during pregnancy ?

a) Yes b) No c) Not known

Illness(Malnutrition,Vomiting, Fever,Chickenpox,Mumpsetc)		Exposure to animals (esp.cats) describe	
German measles		Hypertension	
Accidental or Injury		Psychological trauma	
Threatened abortion		PE Toxemia	
Any hormonal problem		Alcohol	
Diabetes		APH	
Irradiation		IUGR	
Eclampsia		Anemia	
Smoking		Drug	

2.Did mother get tetanus toxoid before delivery?

3. Fetal movements

a) Normal b) Sluggish c) Excessive d) Not known

PERINATAL HISTORY:

1. a) Premature b) Full term c) Excessive d)Not known
2. gestational age: Weeks……
3. Place of delivery:
   a) House b) Primary care center c) secondary d) Tertiary
4. Type of delivery:
   a) Normal b) Forceps c) Breech d) Caesarian e) Others.
5. Delivered by: a) Normal b) Nurse c) Doctor d) Untrained doctor e) Others.

6. Labors hours :a) Known b) Not known .Hours if known……..

7. Birth Presentation:

a) Vertex b) Breech c) Any other d) Not known.

8.Cord around the neck:

a) Yes b) No c) Not known

9. Excessive bleeding after delivery:

a) Yes b) No c) Not known

10. Resuscitative efforts needed:

a) Yes b) No c) Not known

11.RH factors: Mother :a) Positive b) Negative c) Not known

Child: a) Positive b) Negative c) Not known

12.Birth weight (in gms)……

13. Colour of child:

a) Yellow b) Blue c) Pale d) Negative e) Not known

NEONATAL HISTORY:

a) Jaundice
b) Hyperglycaemia
c) Septicaemia
d) Convulsions
e) Cyanosis
f) Resp.distress
g) Meningitis
h) Infection
i) Encephalitis
j) Incubator care

IMMUNISATION:

a) Not done b) Partial c) Complete d) Not known.

DEVELOPMENTAL MILESTONE:

Recognition by mother

a) Neck control
b) Rolling over
c) Creeping
d) Sitting

e) Crawling
f) Standing
g) Walking

ASSOCIATED PROBLEM:

a) Hearing
b) Vision
c) Speech
d) Mental Retardation
e) Drooling
f) Any other

HISTORY OF HANDEDNESS:

a) Right b)Left c) Not known

OBJECTIVE ASSESSMENT:

1.On Oberservation

a) Built
b) Head control
c) Oro motor control
    i. Chewing
    ii. Speech

POSTURE ☹NORMAL OR ABNORMAL)

Supine
Sitting
Standing

BALANCE REACTION :

Righting reaction
Equilibrium

GAIT :

1. Gait Pattern

a) Non ambulation
b) Spastic
c) Dystonic
d) Mixed
e) Normal

2.Gait parameter

a) Step length b) Stride length c) Cadence d) Step time e) Stride time

REFLEX:

1. Tonic/Brainstem reflex:

ATNR		
STNR		
TLR		

2. Midbrain/Cortical reflex:

NOB		
BOM		
BOB		

3. Stretch reflex:

Biceps		
Triceps		
Supinator		
Knee		
Ankle		

3. Superficial reflex reflex:

Abdominal		
Plantar		

MOTOR EXAMINATION :

Joint	Deformity	Contracture	Body part	Tone	Vol. Control	Wasting
Shoulder			Arm			
Elbow			Forearm			
Wrist			Hand			
MCPs			Finger			
IPs			Thigh			
Trunk			Leg			

Hip			Foot			
Knee			Toes			
Ankle						
Foot						

HAND FUNCTION:

Reaching

Grasping

Releasing

BLADDER AND BOWEL:

FUNCTIONAL ASSESSMENT:

PROVISIONAL DIAGNOSIS:

SURGICAL NOTE:

INVESTIGATION:

PHYSICAL DIAGNOSIS:

Primary Impairment:

Secondary Impairment:

Composite Impairment:

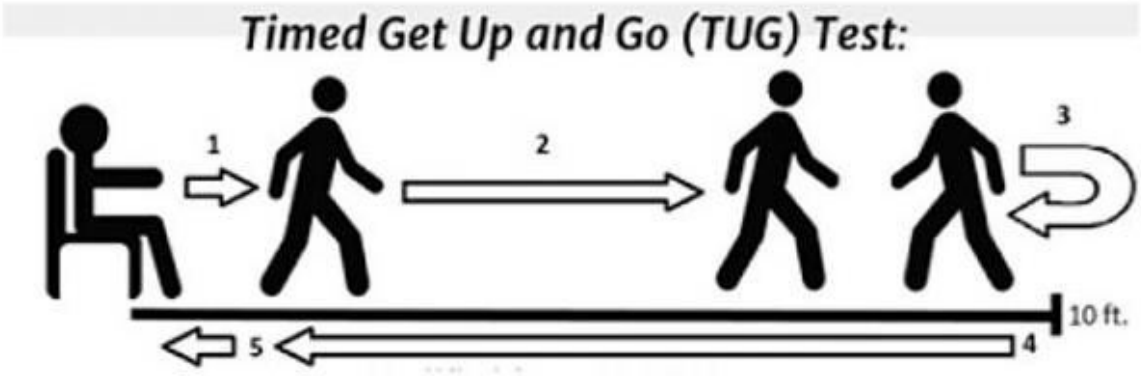
FUNCTIONAL LIMITATION:

GOALS:

Short term goal:

Long term goal:

ANNEXURE III
MODIFIED TIMED UP AND GO TEST:



Timed Up and Go, or "TUG", is an assessment that can be completed while a senior is attending a routine office visit with their Primary Care Physician. The individual sits with their back against the chair and on the command "go", the patient rises from their chair, walks 3 meters, then walks back to their chair to sit back down. When the patient is seated the time stops. If it takes the patient more than 12 seconds to complete the assessment, they are considered to be at risk of falling. The TUG assessment is quick, informative, and effective.

- **PAEDIATRIC BALANCE SCALE :**

Name:
Location:
Examiner:

S.NO	PAEDIATRIC BALANCE SCALE	SCORE
` 1	**Sitting to standing** **"Hold your arms up and stand up"** 4- able to stand without using hands and stabilize independently 3- able to stand independently using hands 2- able to stand using hands after several tries 1- needs minimal assist to stand or tostabilize 0- needs moderate or maximal assist to stand	

2	**Standing to sitting** **"Sit down slowly without using your hands"** 4- sits safely with minimal use of hands 3- controls descent by using hands 2- uses back of legs against chair to control descent 1- sits independently, but has uncontrolled descent 0- needs assistance to sit	
3	**Transfers** 4- able to transfer safely with minor use of hands 3- able to transfer safely; definite need of hands 2- able to transfer with verbal cuing and/or supervision (spotting) 1- needs one person to assist 0- needs two people to assist or supervise (close guard) to be safe	
4	**Standing unsupported** 4- able to stand safely 30 seconds 3- able to stand 30 seconds with supervision (spotting) 2- able to stand 15 seconds unsupported 1- needs several tries to stand 10 seconds unsupported 0- unable to stand 10 seconds unassisted	
5	**Sitting unsupported** **"Sit with your arms folded on your chest for 30 seconds"** 4- able to sit safely and securely 30 seconds 3- able to stand 30 seconds under supervision (spotting) or may require define use of upper extremities to maintain sitting position 2- able to sit 15 seconds 1- able to sit 10 seconds 0- unable to sit 10 seconds without support	

6	**Standing with eyes closed** **"When I say close your eyes,I want you to stand still,close your eyes, and keep them closed until I say open"** 4- able to stand 10 seconds safely 3- able to stand 10 seconds with supervision(spotting) 2- able to stand 3seconds 1- Unable to keep eyes closed 3 seconds, but stays steady. 0- Needs help to keep from falling	
7	**Standing with feet together:** 4- able to place feet together independently and stand 30 seconds safely 3- able to place feet together independently and stand for 30 seconds with supervision.(spotting) 2- able to place feet together independently but unable to hold for 30 seconds 1- needs help to attain position but able to stand 30 seconds with feet together. 0- needs help to attain position and or unable to hold for 30 seconds.	
8	**Standing with one foot in front** 4- able to place feet tandem independently and hold 30 seconds. 3- able to place foot ahead of others independently and hold for 30 seconds 2- able to take small step independently and hold for 30 seconds 1- needs help to step,but can hold 15 seconds . 0- lose balance while stepping or standing	
9	**Standing on one foot** 4- able to lift leg independently and hold 10 seconds. 3- able to lift leg independently and hold 5-9 seconds	

	2- able to to lift leg independently and hold 3-4 seconds 1- Tries to lift leg;unable to hold 3 seconds but remains standing. 0- Unable to try or needs assist to prevent fall.	
10	**Turning 360 degree** **"Turn completely around in a full circle,STOP.then turn a full circle in the other direction"** 4- able to turn 360 degrees safely in 4 seconds or less each way 3- able to turn 360 degrees safely in 1 seconds only in 4 seconds 2- able to turn 360 degrees safely but slowly 1- needs close supervision or constant verbal cuing 0- needs assistance while turning	
11	**Turning to look behind** **"Follow this object as I move it. Keep watching it as I move it, but don't move your feet."** 4- Looks behind /over each shoulder;weight shifts include trunk rotation 3-Looks behind/over one shoulder with trunk rotation 2- Turns head to look to level of shoulder with trunk rotation. 1- needs supervision when turning , the chin moves greater than half the distance to the shoulder 0- needs assistance to keep from losing balance or falling ;movement of the chin is less than half the distance to the shoulder	
12	**Retrieving object from the floor on stool** 4- able to pick up chalk board eraser safely and easily 3-able to pick up eraser but needs supervision 2-Unable to pickup eraser but reaches 1-2 inches from eraser and keeps balance independently	

	1-Unable to pickuperaser;needs spotting while attempting 0-Unable to try,needs assist to keep from losing balance or falling	
13	**Place alternate foot on stool:** 4- Stands independently and safely and completes 8 steps in 20 seconds 3-able to stand independently and complete 8 steps > 20 seconds 2-able to complete 4 steps without assistance ,but requires close supervision 1-able to complete 2 steps; needs minimal assistance 0-needs assistance to maintain balance or keep from falling, unable to try	
14	**Reaching forward with outstretched arm:** **"Stretch out your fingers, make a fist and reach forward as far as you can without moving your feet"** 4-reaches forward confidently >10 inches 3-reaches forward >5 inches,safely 2-reaches forward>2 inches ,safely 1-reaches forward but needs supervision 0-loses balance while trying, requires external support	

ANNEXURE-IV

GROSS MOTOR FUNCTION MEASURES-88:

GROSS MOTOR FUNCTION MEASURE (GMFM)

SCORE SHEET (GMFM-88)

Child's Name:……

Assessment Date: year / month /Date

GMFCS Level-I-II-III-IV-V

Date of Birth: year / month / day

Chronological: year / month

Evaluator's Name:

SCORING KEY

0 = does not initiate

1 = initiates

2 = partially completes

3 = completes

NT= not tested

Check (3) the appropriate score: if an item is not tested (NT), circle the item number on the right column

	Item	A: LYING & ROLLING	SCORE				NT
	1.	SUP, HEAD IN MIDLINE: TURNS HEAD WITH EXTREMITIES SYMMETRICAL	0☐	1☐	2☐	3☐	1.
*	2.	SUP: BRINGS HANDS TO MIDLINE, FINGERS ONE WITH THE OTHER	0☐	1☐	2☐	3☐	2.
	3.	SUP: LIFTS HEAD 45°	0☐	1☐	2☐	3☐	3.
	4.	SUP: FLEXES R HIP & KNEE THROUGH FULL RANGE	0☐	1☐	2☐	3☐	4.
	5.	SUP: FLEXES L HIP & KNEE THROUGH FULL RANGE	0☐	1☐	2☐	3☐	5.
*	6.	SUP: REACHES OUT WITH R ARM, HAND CROSSES MIDLINE TOWARD TOY	0☐	1☐	2☐	3☐	6.
*	7.	SUP: REACHES OUT WITH L ARM, HAND CROSSES MIDLINE TOWARD TOY	0☐	1☐	2☐	3☐	7.
	8.	SUP: ROLLS TO PR OVER R SIDE	0☐	1☐	2☐	3☐	8.
	9.	SUP: ROLLS TO PR OVER L SIDE	0☐	1☐	2☐	3☐	9.
*	10.	PR: LIFTS HEAD UPRIGHT	0☐	1☐	2☐	3☐	10.
	11.	PR ON FOREARMS: LIFTS HEAD UPRIGHT, ELBOWS EXT., CHEST RAISED	0☐	1☐	2☐	3☐	11.

	Item	B: SITTING	SCORE				NT
*	18.	SUP, HANDS GRASPED BY EXAMINER: PULLS SELF TO SITTING WITH HEAD CONTROL	0☐	1☐	2☐	3☐	18.
	19.	SUP: ROLLS TO R SIDE, ATTAINS SITTING	0☐	1☐	2☐	3☐	19.
	20.	SUP: ROLLS TO L SIDE, ATTAINS SITTING	0☐	1☐	2☐	3☐	20.
*	21.	SIT ON MAT, SUPPORTED AT THORAX BY THERAPIST: LIFTS HEAD UPRIGHT, MAINTAINS 3 SECONDS	0☐	1☐	2☐	3☐	21.
*	22.	SIT ON MAT, SUPPORTED AT THORAX BY THERAPIST: LIFTS HEAD MIDLINE, MAINTAINS 10 SECONDS	0☐	1☐	2☐	3☐	22.
*	23.	SIT ON MAT, ARM(S) PROPPING: MAINTAINS, 5 SECONDS	0☐	1☐	2☐	3☐	23.
*	24.	SIT ON MAT: MAINTAIN, ARMS FREE, 3 SECONDS	0☐	1☐	2☐	3☐	24.
*	25.	SIT ON MAT WITH SMALL TOY IN FRONT: LEANS FORWARD, TOUCHESTOY, RE-ERECTS WITHOUT ARM PROPPING	0☐	1☐	2☐	3☐	25.
*	26.	SIT ON MAT: TOUCHES TOY PLACED 45° BEHIND CHILD'S R SIDE, RETURNS TO START	0☐	1☐	2☐	3☐	26.
*	27.	SIT ON MAT: TOUCHES TOY PLACED 45° BEHIND CHILD'S L SIDE, RETURNS TO START	0☐	1☐	2☐	3☐	27.
	28.	R SIDE SIT: MAINTAINS, ARMS FREE, 5 SECONDS	0☐	1☐	2☐	3☐	28.
	29.	L SIDE SIT: MAINTAINS, ARMS FREE, 5 SECONDS	0☐	1☐	2☐	3☐	29.
*	30.	SIT ON MAT: LOWERS TO PR WITH CONTROL	0☐	1☐	2☐	3☐	30.
*	31.	SIT ON MAT WITH FEET IN FRONT: ATTAINS 4 POINT OVER R SIDE	0☐	1☐	2☐	3☐	31.

*	32.	SIT ON MAT WITH FEET IN FRONT: ATTAINS 4 POINT OVER L SIDE	0☐	1☐	2☐	3☐	32.
	33.	SIT ON MAT: PIVOTS 90°, WITHOUT ARMS ASSISTING	0☐	1☐	2☐	3☐	33.
*	34.	SIT ON BENCH: MAINTAINS, ARMS AND FEET FREE, 10 SECONDS.....	0☐	1☐	2☐	3☐	34.
*	35.	STD: ATTAINS SIT ON SMALL BENCH	0☐	1☐	2☐	3☐	35.
*	36.	ON THE FLOOR: ATTAINS SIT ON SMALL BENCH	0☐	1☐	2☐	3☐	36.
*	37.	ON THE FLOOR: ATTAINS SIT ON LARGE BENCH	0☐	1☐	2☐	3☐	37.

TOTAL DIMENSION B ☐

Item	C: CRAWLING & KNEELING	SCORE				NT
	38. PR: CREEPS FORWARD 1.8m (6')	0☐	1☐	2☐	3☐	38.
*	39. 4 POINT: MAINTAINS, WEIGHT ON HANDS AND KNEES, 10 SECONDS	0☐	1☐	2☐	3☐	39.
*	40. 4 POINT: ATTAINS SIT ARMS FREE	0☐	1☐	2☐	3☐	40.
*	41. PR: ATTAINS 4 POINT, WEIGHT ON HANDS AND KNEES	0☐	1☐	2☐	3☐	41.
*	42. 4 POINT: REACHES FORWARD WITH R ARM, HAND ABOVE SHOULDER LEVEL	0☐	1☐	2☐	3☐	42.
*	43. 4 POINT: REACHES FORWARD WITH L ARM, HAND ABOVE SHOULDER LEVEL.....	0☐	1☐	2☐	3☐	43.
*	44. 4 POINT: CRAWLS OR HITCHES FORWARD 1.8m(6').....	0☐	1☐	2☐	3☐	44.
*	45. 4 POINT: CRAWLS RECIPROCALLY FORWARD 1.8m (6').....	0☐	1☐	2☐	3☐	45.
*	46. 4 POINT: CRAWLS UP 4 STEPS ON HANDS AND KNEES/FEET	0☐	1☐	2☐	3☐	46.
	47. 4 POINT: CRAWLS BACKWARDS DOWN 4 STEPS ON HANDS AND KNEES/FEET	0☐	1☐	2☐	3☐	47.
*	48. SIT ON MAT: ATTAINS HIGH KN USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	48.
	49. HIGH KN: ATTAINS HALF KN ON R KNEE USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	49.
	50. HIGH KN: ATTAINS HALF KN ON L KNEE USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	50.
*	51. HIGH KN: KN WALKS FORWARD 10 STEPS, ARMS FREE	0☐	1☐	2☐	3☐	51.

TOTAL DIMENSION C ☐

Item		D: STANDING	SCORE				NT
*	52.	ON THE FLOOR: PULLS TO STD AT LARGE BENCH	0☐	1☐	2☐	3☐	52.
*	53.	STD: MAINTAINS, ARMS FREE, 3 SECONDS	0☐	1☐	2☐	3☐	53.
*	54.	STD: HOLDING ON TO LARGE BENCH WITH ONE HAND, LIFTS R FOOT, 3 SECONDS	0☐	1☐	2☐	3☐	54.
*	55.	STD: HOLDING ON TO LARGE BENCH WITH ONE HAND, LIFTS L FOOT, 3 SECONDS	0☐	1☐	2☐	3☐	55.
*	56.	STD: MAINTAINS, ARMS FREE, 20 SECONDS	0☐	1☐	2☐	3☐	56.
*	57.	STD: LIFTS L FOOT, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	57.
*	58.	STD: LIFTS R FOOT, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	58.
*	59.	SIT ON SMALL BENCH: ATTAINS STD WITHOUT USING ARMS.....	0☐	1☐	2☐	3☐	59.
*	60.	HIGH KN: ATTAINS STD THROUGH HALF KN ON R KNEE, WITHOUT USING ARMS.....	0☐	1☐	2☐	3☐	60.
*	61.	HIGH KN: ATTAINS STD THROUGH HALF KN ON L KNEE, WITHOUT USING ARMS	0☐	1☐	2☐	3☐	61.

*	62.	STD: LOWERS TO SIT ON FLOOR WITH CONTROL, ARMS FREE	0☐	1☐	2☐	3☐	62.
*	63.	STD: ATTAINS SQUAT, ARMS FREE	0☐	1☐	2☐	3☐	63.
*	64.	STD: PICKS UP OBJECT FROM FLOOR, ARMS FREE, RETURNS TO STAND	0☐	1☐	2☐	3☐	64.

TOTAL DIMENSION D ☐

Item		E: WALKING, RUNNING & JUMPING	SCORE				NT
*	65.	STD, 2 HANDS ON LARGE BENCH: CRUISES 5 STEPS TO R	0☐	1☐	2☐	3☐	65.
*	66.	STD, 2 HANDS ON LARGE BENCH: CRUISES 5 STEPS TO L.....	0☐	1☐	2☐	3☐	66.
*	67.	STD, 2 HANDS HELD: WALKS FORWARD 10 STEPS	0☐	1☐	2☐	3☐	67.
*	68.	STD, 1 HAND HELD: WALKS FORWARD 10 STEPS.....	0☐	1☐	2☐	3☐	68.
*	69.	STD: WALKS FORWARD 10 STEPS	0☐	1☐	2☐	3☐	69.
*	70.	STD: WALKS FORWARD 10 STEPS, STOPS, TURNS 180°, RETURNS	0☐	1☐	2☐	3☐	70.
*	71.	STD: WALKS BACKWARD 10 STEPS	0☐	1☐	2☐	3☐	71.
*	72.	STD: WALKS FORWARD 10 STEPS, CARRYING A LARGE OBJECT WITH 2 HANDS.....	0☐	1☐	2☐	3☐	72.
*	73.	STD: WALKS FORWARD 10 CONSECUTIVE STEPS BETWEEN PARALLEL LINES 20cm (8") APART	0☐	1☐	2☐	3☐	73.
*	74.	STD: WALKS FORWARD 10 CONSECUTIVE STEPS ON A STRAIGHT LINE 2cm (3/4") WIDE	0☐	1☐	2☐	3☐	74.
*	75.	STD: STEPS OVER STICK AT KNEE LEVEL, R FOOT LEADING	0☐	1☐	2☐	3☐	75.
*	76.	STD: STEPS OVER STICK AT KNEE LEVEL, L FOOT LEADING	0☐	1☐	2☐	3☐	76.
*	77.	STD: RUNS 4.5m (15'), STOPS & RETURNS.....	0☐	1☐	2☐	3☐	77.
*	78.	STD: KICKS BALL WITH R FOOT	0☐	1☐	2☐	3☐	78.
*	79.	STD: KICKS BALL WITH L FOOT.....	0☐	1☐	2☐	3☐	79.
*	80.	STD: JUMPS 30cm (12") HIGH, BOTH FEET SIMULTANEOUSLY	0☐	1☐	2☐	3☐	80.
*	81.	STD: JUMPS FORWARD 30 cm (12"), BOTH FEET SIMULTANEOUSLY.....	0☐	1☐	2☐	3☐	81.
*	82.	STD ON R FOOT: HOPS ON R FOOT 10 TIMES WITHIN A 60cm (24") CIRCLE.....	0☐	1☐	2☐	3☐	82.
*	83.	STD ON L FOOT: HOPS ON L FOOT 10 TIMES WITHIN A 60cm (24") CIRCLE	0☐	1☐	2☐	3☐	83.
*	84.	STD, HOLDING 1 RAIL: WALKS UP 4 STEPS, HOLDING 1 RAIL, ALTERNATING FEET	0☐	1☐	2☐	3☐	84.
*	85.	STD, HOLDING 1 RAIL: WALKS DOWN 4 STEPS, HOLDING 1 RAIL, ALTERNATING FEET	0☐	1☐	2☐	3☐	85.
*	86.	STD: WALKS UP 4 STEPS, ALTERNATING FEET	0☐	1☐	2☐	3☐	86.
*	87.	STD: WALKS DOWN 4 STEPS, ALTERNATING FEET	0☐	1☐	2☐	3☐	87.
*	88.	STD ON 15cm (6") STEP: JUMPS OFF, BOTH FEET SIMULTANEOUSLY	0☐	1☐	2☐	3☐	88.

TOTAL DIMENSION E ☐

GMFM-88 SUMMARY SCORE

DIMENSION SCORES	CALCULATION OF DIMENSION %	GOAL AREA (indicated with ✓ check)
A. Lying & Rolling	Total Dimension A / 51 = _____ × 100 / 51 = _____ %	A. ☐
B. Sitting	Total Dimension B / 60 = _____ × 100 / 60 = _____ %	B. ☐
C. Crawling & Kneeling	Total Dimension C / 42 = _____ × 100 / 42 = _____ %	C. ☐
D. Standing	Total Dimension D / 39 = _____ × 100 / 39 = _____ %	D. ☐
E. Walking, Running & Jumping		

TOTAL SCORE = (%A + %B + %C + %D + %E) / Total # of Dimensions

= _____ / 5 = _____ = _____ %

GOAL TOTAL SCORE = Sum of %scores for each dimension identified as a goal area / # of Goal areas

= _____ = _____ %

BODY WEIGHT SUPPORTED TREADMILL

ANNEXURE V
MASTER CHART

S.NO	AGE	SEX	GROUP A					
			GMFM		MTUGT		PBS	
			PRE	POST	PRE	POST	PRE	POST
1.	10	M	74.91	84.16	16	14	34	46
2.	13	M	76.46	82.55	15	12	31	40
3.	11	F	69.07	77.14	17	16	29	39
4.	9	F	75.92	84.98	16	15	37	45
5.	11	F	70.49	77.71	15	12	30	40
6.	8	M	67.02	83.52	18	15	38	43
7.	10	F	70.28	78.33	16	14	33	39
8.	9	F	78.33	85.10	15	14	31`	42
9.	11	M	65.92	77.11	16	13	32	45
10.	12	M	69.28	74.01	16	14	32	40
11.	13	F	68.14	77.11	17	15	34	43
12.	14	M	69.28	75.54	15	14	39	48

S.NO	AGE	SEX	GROUP B					
			GMFM		MTUGT		PB S	
			PRE	POST	PRE	POST	PRE	POST
1.	10	F	75.47	93.23	16	8	29	42
2.	13	M	69.74	88.2	17	10	34	51
3.	9	F	74.04	92.37	17	14	36	53
4.	9	F	79.59	94.11	18	14	32	42
5.	11	F	67.93	85.39	16	10	31	42
6.	8	M	69.28	89.48	15	9	36	48
7.	11	F	77.06	93.49	18	12	32	45
8.	10	F	67.19	85.59	16	12	33	43
9.	8	M	67.80	91.49	17	10	37	50
10.	9	M	65.48	86.52	18	14	38	51
11.	12	F	78.53	95.23	15	10	29	39
12.	8	M	68.14	88.51	16	9	39	50